Rubber World

The technical service magazine for the rubber industry

Volume 190, No. 5 August 1984

Emphasis on adhesives

Troubleshooting rubber-to-metal bonding

Cord-to-rubber adhesion

Resorcinol bonding systems

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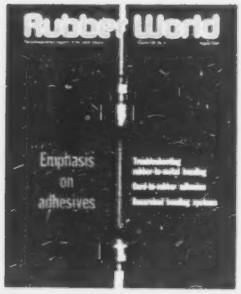

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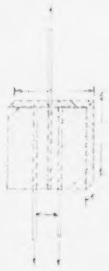
Acquisitions, expansions; contracts, licenses; financial statements; price changes; markets, news.

12 Tech Service — Using water for the solution.
by Jon Menough, contributing technical service editor. A look at water-borne adhesives in rubber-to-metal bonding.

18 Troubleshooting rubber-to-metal bonding problems in transfer molding
by Everett H. Gibbs, Jr. and John N. Seber, Teledyne Monarch Rubber. When a failure occurs in a rubber part bonded to metal, either through deliberate destruction or in service, the mode of failure is important in determining what steps are to be taken to solve the problem. This article examines the various modes and suggests ways to correct the problem.

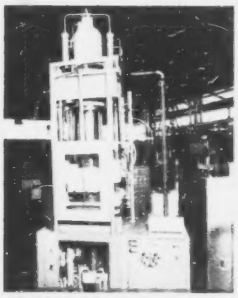


Cord-to-rubber adhesion p. 29

24 Resorcinol bonding systems for steel cord adhesion
by Alex Peterson and M.I. Dietrick, Koppers Company. With increased emphasis on longer service life for steel radial passenger and truck tires, it is important that the cord to rubber bonds remain strong and durable over a wide range of exposure conditions. This article shows that resorcinol may be replaced with a thermally stable resorcinol-formaldehyde resin in NR skin compounds without sacrificing unaged and aged adhesion.

29 Comprehensive evaluation of cord-to-rubber adhesion
by G.I. Brodsky, Hercules Inc. The author discusses adhesion phenomena and describes a method of testing adhesives in a way which allows one to predict the composite's performance and to find new areas of adhesives applications.

40 New Patents
edited by Bob Samples, Akron Rubber Development



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Cover

Cover photo courtesy of Teledyne Monarch Rubber shows an ASTM D429 method C conical specimen in tension.

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Business Briefs

Acquisitions, expansions

Cabot Corp. will expand carbon black production capacity at its Waverly, WV facility by at least 25 million pounds annually. The new installation, which will be completed in 10 months, is the first phase of a $7 million to $10 million expansion program.

Quabug Rubber Co., has established a separate custom mixing operating unit which will be mixing most polymers, including SBR, neoprene, EPDM, nitrile, butyl and natural rubber beginning in the fall.

Hydril has begun a two-year construction program to expand it's oil field rubber products facility in Humble, TX. The first phase which includes adding 22,000 sq. ft. will be completed in September. The second phase will feature construction of new office buildings, research and development laboratory, raw materials warehouse and a parts distribution center.

TRW Inc. purchased Firestone's passenger restraint business.

Eagle Chemical Co., a sales organization representing more than a dozen rubber chemical manufacturers, was formed out of the reorganization of ARC Chemical. Eagle has added warehouses in Memphis, TN and Atlanta, GA.

Montedison USA opened a branch office in San Jose, CA.

Marian Rubber Products Co. purchased the J.J. Glenn Co., Chicago, IL, a distributor of electrical components.

Reichhold Chemical is constructing a new laboratory for its polyolefin and vinyl materials division adjacent to its business office in Washington Township, NJ.

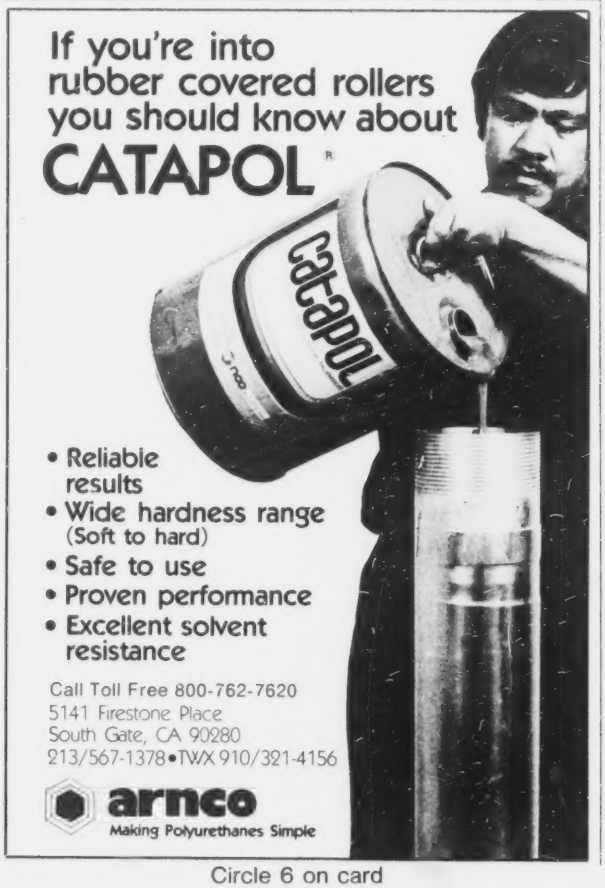
The Gates Rubber Co. dedicated its Red Bay, AL plant which specializes in producing long length wrapped hose and radiator hose.

A multi million dollar expansion will increase production at **Ohio Poly Corp.**, a Goodyear subsidiary, by about 25% upon completion by mid-1985 at the company's Carrollton, OH facility.

Dunlop Olympic Ltd. acquired **Pacific Polymers Inc.**, a manufacturer of latex gloves for the silicon chip industry.

RMA industry rubber report through April 1984 (figures are expressed in metric tons)

	Cumulative 1984	Cumulative 1983	% Change 84 vs 83
Total New Rubber			
New rubber available	1,117,913	909,908	22.86
Imports	378,123	270,181	39.95
Exports	118,282	100,708	17.45
Apparent Consumption	981,901	805,441	21.91
Total Natural Rubber			
Imports	294,946	224,385	31.45
Exports	7,250	6,344	14.28
Apparent Consumption	281,833	219,621	28.33
% Total new rubber	28.70	27.26	
Total Synthetic Rubber			
Production	739,790	639,727	15.64
Imports	83,177	45,796	81.63
Exports	111,032	94,364	17.66
Apparent Consumption	700,068	585,820	19.50
% Total new rubber	71.29	72.73	
Total SBR			
Production	338,690	298,054	13.63
Imports	25,163	16,392	53.51
Exports	33,524	27,104	23.69
Apparent Consumption	318,673	288,213	10.57
Total Nitrile			
Production	21,621	16,843	28.37
Imports	3,902	2,627	48.53
Exports	2,443	1,896	28.85
Apparent Consumption	23,765	17,403	36.56
Polybutadiene			
Production	119,109	107,570	10.73
Imports	24,470	10,593	131.00
Exports	8,203	5,171	58.63
Apparent Consumption	135,892	110,089	23.44
Ethylene-Propylene			
Production	74,487	53,854	38.31
Imports	251	44	512.20
Exports	11,254	10,321	9.04
Apparent Consumption	59,206	42,562	39.11
Butyl, Polyisoprene, Silicone and other Synthetic Elastomers			
Production	145,908	121,375	20.21
Imports	28,197	15,273	84.62
Exports	42,498	33,836	25.60
Apparent Consumption	133,672	101,209	32.08
Polychloroprene			
Production	39,976	42,032	−4.89
Imports	1,194	870	37.24
Exports	13,110	16,036	−18.25
Consumption	28,861	26,345	9.55



Circle 6 on card

RMA monthly tire shipments & production report through April 1984 (figures in thousands of units)

Passenger Tires	1984	1983	% Change
Shipments			
Original Equipment	18,000	12,924	+39.28
Radial	15,030	10,808	+39.06
Replacement	45,934	40,386	+13.74
Radial	35,742	27,490	+30.02
Export	2,140	1,262	+69.57
Radial	1,611	816	+ 97.43
Total	66,074	54,572	+21.08
Radial	52,383	39,114	+33.92
Production	58,392	53,641	+ 8.86
Radial	43,127	37,472	+15.09
Ending Inventory	31,118	42,810	−27.31
Radial	22,048	32,743	−32.66
Truck & Bus Tires			
Shipments			
Original Equipment	2,562	1,610	+59.13
Radial	1,327	784	+69.26
Replacement	9,665	8,446	+14.43
Radial	3,421	2,586	+32.29
Export	453	328	+38.11
Radial	221	142	+55.63
Total	12,680	10,384	+22.11
Radial	4,969	3,512	+41.49
Production	11,962	10,552	+13.36
Radial	4,354	3,339	+30.40
Ending Inventory	6,908	9,111	−24.18
Radial	2,761	4,104	−32.72

Pennsylvania Glass Sand Corp. is undertaking a $6.6 million modernization and expansion program at four of its six ground silica plants. Combined capacity for the specialty products after the completion of the expansion program will exceed one million tons per year.

Contracts, licenses

The Materials, Chemicals and Vehicle Requirements Board of the U.K. Department of Trade and Industry has contracted to make £540,000 available to support the work carried out within the Members Program of research and development at the **Rubber and Plastics Research Association**. Payments by the board will be matched by contributions from RAPRA members and from the association's funds to bring the total value to over £1 million.

Kent Manufacturing Co., Grand Rapids, MI will handle the sales of **Roger Corp.'s** cellular urethane industrial products in Western Michigan.

Littleford Bros. Inc. named **Landcaster Corp.**, Baton Rouge, LA, as sales representatives in southern Louisiana and southeast Texas for its line of "Aer-O-Tek" material nadling equipment.

L.V. Lomas Chemical Co., Mississauga, Ontario was named full lime stocking distributor for **Solem Industries'** alumina trihydrate.

Financial statements

Alliance Tire and Rubber of Israel reported consolidated net sales for 1983 were IS. 5.4 million with a loss in earnings of IS. 539.3 million.

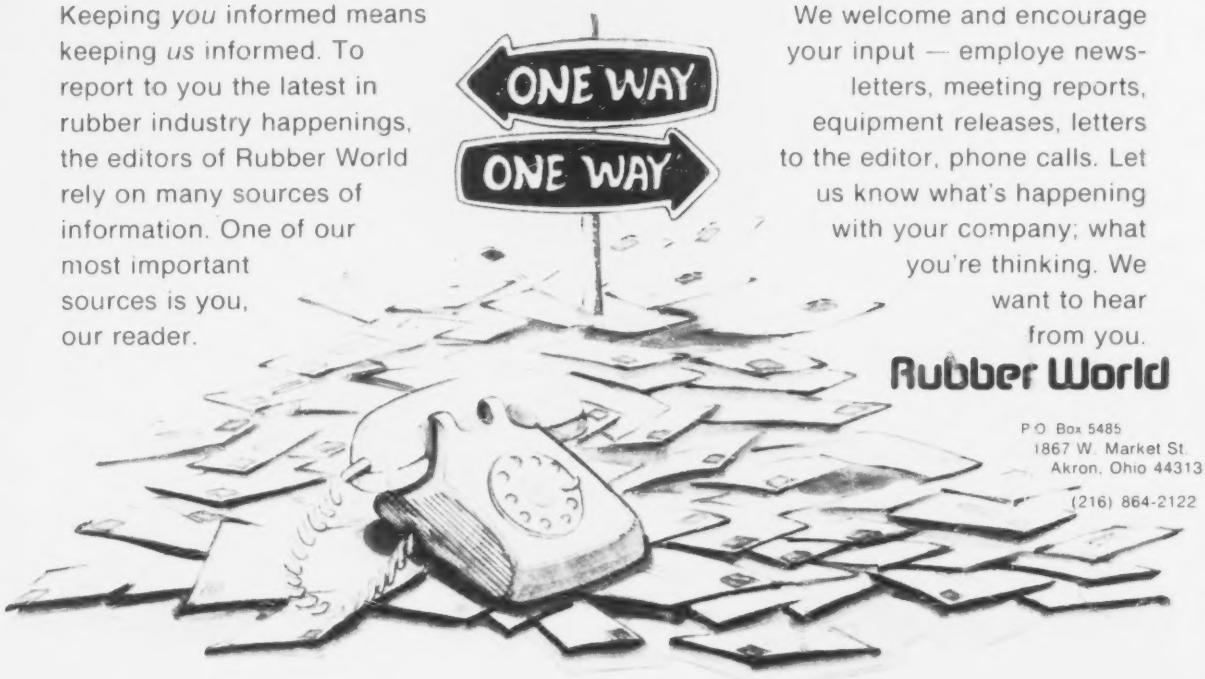
Blasius Industries reported fiscal 1984 net earnings of $1.7 million on sales of $42.7 million.

Brad Ragan, Inc. reported revenues of $178.8 million and net income of $1.6 million for fiscal 1984.

Eagle-Picher Industries had second quarter earnings of

It's a two-way street

Keeping *you* informed means keeping *us* informed. To report to you the latest in rubber industry happenings, the editors of Rubber World rely on many sources of information. One of our most important sources is you, our reader.



We welcome and encourage your input — employe newsletters, meeting reports, equipment releases, letters to the editor, phone calls. Let us know what's happening with your company; what you're thinking. We want to hear from you.

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$17.1 million on sales of pf $180.9 million.

GenCorp posted net earnings of $22.3 million for the second quarter on sales of $594.4 million.

Rubbermaid Inc. reported net sales for the second quarter were $119 million and net earnings were $9 million.

Markets, news

First quarter production of furnace black increased 20% and shipments 16% from the same period of 1983 to 323 thousand metric tons each, according to Columbian Chemicals. This was the highest production in three years and the highest shipments since the fourth quarter of 1980. Demand in all grades was up, with N-600 the strongest in four years and N-300 the highest in three years. Plant inventories of 68 MMT represented less than a three week supply based on first quarter 1984 shipments.

Paralleling the carbon black industry performance, U.S.A. dry rubber hydrocarbon consumption rose to the highest level since the second quarter of 1979. Totaling 708 thousand metric tons, this was 27% over the year ago level, Columbian reports. All polymers were up, with EPDM having a record quarter and Natural Rubber the highest since the second quarter of 1977. Both rubber ratios were lower than 1983. The synthetic share declined from 73.1% to 71.4% and carbon black from 49.4 to 44.8 parts per hundred rubber.

The BFGoodrich company has announced that it is renewing its membership in the International Institute of Synthetic Rubber Producers (IISRP). "We elected to withdraw as members of IISRP three years ago during a period of intensive evaluation and analysis of the synthetic rubber business," said Kendall Greene, vice president and general manager of the Ameripol SBR Division. Greene noted that the SBR division has made a transition from the Chemical Group to the Tire Group, including a physical move of personnel from Independence, Ohio to the BFGoodrich World Headquarters complex in Akron, Ohio. "To better serve the needs of our SBR customers, we established a separate sales force and sales service group," he said. "Our combined marketing, sales, R&D, purchasing and production capabilities are directed toward the important general purpose rubber markets served by SBR," he said. He noted that the capital improvement program at the division's Port Neches, Texas, plant has been significantly increased.

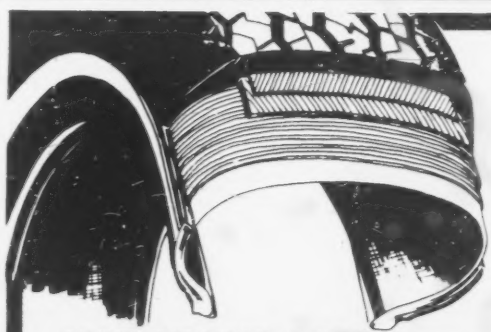
"Our decision to rejoin the IISRP is based on the substantial productivity gains we have made and our long-term commitment to the general purpose SBR business," said Greene. "As we have done in the past, we expect to be an active participant in Institute activities and look forward to renewing our relationships with the Institute and its other members."

The U.S. Department of Commerce's 1982 Census of Manufacturers of the rubber and plastics hose and belting industry shows employment at 24,700,a 28% decrease from the last census in 1977. The figure is 8% less compared to 1981 data based on a sample survey. The total value of shipments in this industry was $1,958 million. The quantities of the materials consumed by this industry dropped in all instances from the 1977 figures. SBR is the most consumed material at 65.1 million pounds followed by ethylene-propylene at 43.1 m/lbs., reclaimed rubber 28.5 m/lbs., polychloroprene 28.1 m/lbs. and nitrile 22.5 m/lbs.

Carbon black industry in the U.S.A.
(Metric Tons)

			Percentage Change from	
		1st Qtr. 1984	4th Qtr. 1983	1st Qtr. 1983
N-100 (SAF)	Prod.	6,037	(4.5%)	+14.9%
	Ship.	6,362	(6.5%)	+21.2%
N-200 (ISAF)	Prod.	35,426	(7.6%)	+34.2%
	Ship.	36,629	(3.1%)	+28.3%
N-300 (HAF)	Prod.	142,365	+13.0%	+15.6%
	Ship.	137,868	+ 5.8%	+12.2%
N-500 (FEF)	Prod.	28,475	+14.9%	+31.2%
	Ship.	28,527	+11.4%	+16.0%
N-600 (GPF)	Prod.	80,638	+ 2.1%	+17.5%
	Ship.	81,539	+ 1.7%	+15.6%
N-700 (SRF)	Prod.	29,889	(6.1%)	+22.6%
	Ship.	31,754	(10.8%)	+15.0%
Total	Prod.	322,830	+ 5.4%	+19.8%
	Ship.	322,679	+ 2.0%	+15.5%
Domestic Shipments (Included Above)		316,965	+ 2.1%	+15.6%
Domestic Share		98.2%		

The United Rubber Workers said it considers Korean tire imports injurious to the U.S. tire industry and that it is "fully supportive of the anit-dumping petition recently filed by the industry against radial passenger tires imported from South Korea," according to Milan Stone, URW International president. "The URW has been seriously concerned about imported tires for many years because increased imports mean fewer jobs for American workers," he said "This isn't good for the tire industry nor is it good for the American economy." Korean imports have increased their share of a growing market by using unfair pricing methods, according to the petition.



MANOBOND 680C improves humidity resistance and adhesion retention in steel-belted radials.

Manobond 680C, a 23% cobalt bonding agent in pastille form, has been developed to provide high humidity resistance and increased adhesion retention in steel belted radial tires and reinforced conveyor belting. It is especially effective when bonding polymers including NR, SBR, and BR to steel cord substrates such as brass, zinc and bare steel.

Manobond 680C also reduces environmental hazards associated with heavy metal dust, permits automatic weighing, improves weighing accuracy, and reduces waste.

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Exciting growth ahead for the adhesive and sealant industry

by William R. Schmitz

The adhesive and sealant industry has, for many years, been characterized by high sales growth and, in this regard, compares very favorably with many of our important industries. Adhesives and sealants are used in virtually every major market — most notably in packaging, housing and construction, automotive and aerospace, furniture, electronics, appliances, bookbindings, shoes and apparel, and the "do-it-yourself" consumer market.

Since our products must be formulated to meet a vast range of conditions and specifications, the industry is highly diverse and technologically complex. As such, it remains a mystery to many of our consuming publics. In addition, since successful marketing so often is dependent upon a company's formulating skills and ability to work closely with the consumer, many companies tend to minimize the advertising resource and, instead, favor the one-to-one selling and service approach — and thus perpetuate a limited appreciation of the scope of the industry.

Manufacturers of adhesives and sealants have long recognized the unlimited potential for their products and have emphasized research and development to add to their technology base and yield improved, more sophisticated products for existing and emerging markets. Today adhesives and sealants play a key role in improving productivity and reducing energy consumption as they steadily replace traditional methods of fastening and joining.

New engineering adhesives and sealants — as exemplified by self crosslinking acrylics, epoxies, silicones, cyanoacrylates, anerobics, and urethanes — are all in an increasing sales trend because of their unique properties and their ability to fulfill more difficult bonding requirements. No doubt in the years ahead we will find that old-style mechanical fasteners will be largely replaced by synthetic adhesives.

Rubber-based products continue to play an important role in a number of product lines offered by adhesive and sealant manufacturers. Although the need to include solvents has caused the formulator to modify formulations in order to comply with existing government regulations, properties that still can only be obtained through rubber solvent systems suggest that for the near term and probably long term as well, rubberbased adhesives and sealants will continue to play an important part in this industry's product lines.

Today's adhesive and sealant industry is made up of a number of large companies that include Avery International, H.B. Fuller, Ashland Chemical, Loctite, National Starch and Chemical, Products Research and Chemical,

Adhesives and sealants (SIC 2891): trends and projections 1972-84
(in millions of dollars except as noted)

Item	1972	1977	1979	1981	1982[1]	1983[2]	Compound annual rate of growth 1972-83	1984[3]	Percent change 1983-84
Industry data									
Value of shipments[4]	928.0	1,813.1	2,340.8	2,707.8	2,600.0	2,910.0	10.9	—	—
Value of shipments (1972$)[4]	928.0	1,159.3	1,373.4	1,131.1	1,035.0	1,145.0	1.9	1,225.0	7.0
Total employment (000)	14.9	16.7	17.8	17.0	16.4	15.8	0.5	16.0	1.3
Production workers (000)	8.5	10.2	10.1	10.3	9.7	9.3	0.8	9.5	2.2
Average hourly earnings of production workers ($)	3.91	5.51	6.11	7.34	8.02	8.42	7.2	—	—
Capital expenditures	24.9	39.0	62.9	73.7	—	—	—	—	—
Product data									
Value of shipments[5]	954.2	1,873.1	2,366.3	2,745.0	2,660.0	2,970.0	10.9	—	—
Value of shipments (1972$)[5]	954.2	1,197.6	1,388.7	1,146.6	1,170.0	1.9	1,255.0	7.3	
Product price index (1972 = 100)	100.0	156.3	170.5	239.3	262.8	254.0	8.8	—	—
Trade									
Value of exports	32.1	102.0	96.2	118.0	87.4	84.0	9.1	90.0	7.1
Value of imports	24.5	52.2	32.6	40.7	36.9	40.0	4.6	42.0	5.0
Import/shipments ratio	0.039	0.069	0.052	0.057	0.033	0.028	—	—	—
Import/new supply ratio[6]	0.108	0.123	0.072	0.082	0.014	0.013	—	—	—

[1]Estimated except for product price index, exports, and imports.
[2]Estimated.
[3]Forecast.
[4]Value of all products and service sold by industry SIC 2891.
[5]Value of shipments of Adhesives and sealants products produced by all industries.
[6]New supply is the sum of product shipments plus imports.
Source: Bureau of the Census and Bureau of Industrial Economics. Estimates and forecasts by the Bureau of Industrial Economics.

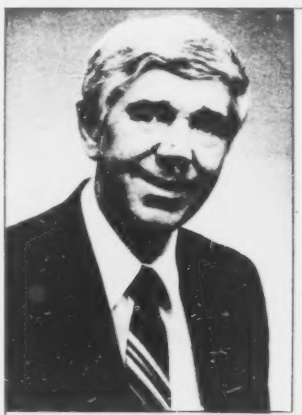
and 3M. In addition to these leading companies and others of their size, are many medium-size and small companies. Although a fair percentage are still family owned and operated, over the past 20 years there has been a shift towards reliance upon professional management to realize company growth and profit. In recent years, many companies have recognized the significant opportunities for marketing their products to industrial nations and developing countries, and I foresee this trend increasing in the years ahead. And I am confident that the research now underway will yield new products and will further propel the industry in new directions.

As the industry has matured, management came to realize that a number of important industry problems could best be addressed through a collective effort. The industry took an important first step this year by supporting a program that will help bring industry and academia closer together.

Through a Pilot Education Program sponsored by The Adhesive and Sealant Council, we will be funding fellowships at the graduate level and scholarships at the undergraduate level at three universities: the University of Connecticut, the University of Akron, and the University of Southern California.

The Pilot Education Program has been organized by the Council to develop a closer working partnership with academia that can result in adding to the technology base and attracting superior students to the adhesive and sealant industry where opportunities for advancement are equal to any of the nation's "growth" industries. A closer relationship with academia also can provide continuing education opportunities for the industry's personnel and lead to the establishment of a Center funded by an ASC Education Foundation.

I have been fortunate to have been associated with the adhesive and sealant industry during the past 13 years. I have witnessed the remarkable growth which has occurred and shared the excitement felt by so many who are a part of this fascinating industry. Future changes in adhesive/sealant formulating technology coupled with new market penetrations should keep our industry growing for many years to come.



William R. Schmitz

William R. Schmitz, President of The Adhesive and Sealant Council Inc., Arlington, Va. is employed by Ashland Chemical Co. as Business Manager of the Adhesive & Sealant operations at its Ashland, Ohio facility. Schmitz, who attended Texas A&M University, has been associated with the adhesive and sealant industry for the past 13 years.

Glossary of adhesive literature

The following glossary of books relating to adhesion was compiled from the catalog of the Rubber Division Library. The books are available for interlibrary loan and can be obtained by contacting Ruth Murray, Information Specialist, ACS Rubber Division Library, The University of Akron, Akron, Ohio, 44325, (216) 375-7197.

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